BIOTYPE DIFFERENTIATION IN SOME SPECIES OF *DICHANTHIUM* WILLEMET, *ISCHAEMUM* LINN., *CHRYSOPOGON* TRIN., *SEHIMA* FORSK., *ISEILEMA* HACK., AND *HETEROPOGON* PERS. FOUND IN PARTS OF WESTERN INDIA*

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ABSTRACT

An analysis of intraspecific variations in more important forage grasses of Western India, belonging to the genera *Dichanthium*, *Ischaemum*, *Chrysopogon*, *Sehima*, *Iseilema* and *Heteropogon* of the tribe *Andropogoneae* has been presented. Under the above six genera 23 species were examined which resulted in isolation of 95 biotypes.

INTRODUCTION

THE taxonomic treatmeent of grasses in parts of Western India has been attempted by Lisboa (1896), Cooke (1909) and Blatter and McCann (1935). Their treatments have been based partly on phylogenetic basis and partly artificial. Bor (1960) has followed purely utilitarian alphabetical order in his treatment of grasses without any phylogenetic considerations. All these botanists have differentiated genera and species by means of well-defined diagnostic key characters. However, none of them has paid any attention to the range of intra-specific variations within a given species. Analysis of such intra-specific variations based on botanical characterization is an essential pre-requisite before any grass breeding programme can be systematically undertaken. Such an attempt was, therefore, made in the more important forage

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grasses in parts of Western India belonging to the genera *Dichanthium, Ischaemum, Chrysopogon, Sehima, Iseilema* and *Heteropogon* of the tribe *Andropogoneae* and as a result 95 biotypes were isolated. The relative observations on these have been summarized below.

Materials and Methods

Material for the study was collected mostly from the Maharashtra State which forms a major portion of the Western India and grown in the experimental plots at Grass Breeding Farm Manjri near Poona. Herbarium specimens of all the biotypes together with their detailed descriptions have been deposited in the Herbarium of the Botany Section, College of Agriculture, Poona 5.

Observations

Botanical characterization of each of the 95 biotypes isolated, has been presented below. Only such characters as are useful for actual differentiation of these biotypes or races at intraspecific levels are considered in the following treatment. The words " accession number " and "locations ", *i.e.*, places of collection have been abbreviated to Ac. No. and Loc. respectively for convenience. These biotypes have been serially presented below.

Biotypes of *Dichanthium annulatum.*—All perennial, 70–80 cm tall, Loc. Poona. (1) Semi-erect, nodes hairy, stem yellow, leaves light green Ac. No. 8, (2) As above excepting leaves bluish green Ac. No. 61, (3) Erect, nodes hairy, stem yellow, leaves dark green Ac. No. 30, (4) Spreading, nodes hairy, stem yellow, leaves dark green, Ac. No. 31, (5) As above excepting leaves bluish green, Ac. No. 58.

Biotypes of *Dichanthium caricosum.*—All perennial, 120–130 cm tall, Loc. Kolhapur, Gadhinglaj, Ajra and Poona, (6) Erect, nodes glabrous, stem yellow, leaves bluish green, Ac. No. 51, (7) As above excepting stem reddish Ac. No. 45, (8) Erect, nodes hairy, stem reddish, leaves bluish green, Ac. No. 45/2, (9) As above excepting stem yellow, Ac. No. 67, (10) Semi-erect, nodes glabrous, stem reddish, leaves bluish green, Ac. No. 36, (11) as above excepting stem yellow, Ac. No. 52, (12) semi-erect, nodes hairy, stem red, leaves bluish green, Ac. No. 18, (13) As above excepting stem yellow, Ac. No. 23, (14) Spreading, nodes glabrous, stem reddish, leaves bluish green, Ac. No. 43, (15) As above excepting stem yellow, Ac. No. 91, (16) As above excepting nodes hairy, Ac. No. 93, (17) Erect, nodes glabrous, stem red, leaves dark green, Ac. No. 48, (18) As above excepting stem yellow, leaves light

green, Ac. No. 40, (19) Erect, nodes hairy, stem reddish, leaves dark green, Ac. No. 45/7, (20) As above excepting stem yellow, Ac. No. 41, (21) Semi-erect, nodes glabrous, stem reddish, leaves dark green, Ac. No. 7, (22) Semi-erect, nodes hairy, stem yellow, leaves light green, Ac. No. 6, (23) Spreading, nodes glabrous, stem reddish, leaves dark green, Ac. No. 35.

Biotypes of *Dichanthium aristatum* (*D. nodosum*).–All perennial, 130–135 cm tall, Loc. Kolhapur, Sangli, Poona and Nasik. (24) Erect, nodes glabrous, stem yellow, leaves dark green, Ac. No. 101, (25) As above excepting stem red, Ac. No. 110, (26) Erect, nodes hairy, stem red, leaves dark green, Ac. No. 103, (27) As above excepting stem is yellow, Ac. No. 115, (28) Erect, nodes glabrous, stem red, leaves bluish green, Ac. No. 113, (29) As above excepting stem is yellow, Ac. No. 102, (30) Erect, nodes hairy, stem red, leaves bluish green, Ac. No. 108, (31) As above except stem is yellow, Ac. No. 109, (32) Semi-erect, nodes hairy, stem red, leaves bluish green, Ac. No. 95, (33) Spreading, nodes hairy, stem red, leaves bluish green, Ac. No. 111, (34) As above excepting stem is yellow, Ac. No. 28, (35) Semi-erect, nodes glabrous, stem red, leaves dark green, Ac. No. 118, (36) As above excepting stem is yellow, Ac. No. 120.

Biotypes of *Ischaemum aristatum*.—All erect, perennial, Loc. for biotype, (40) Khandala: Others Palghar, (37) Height 75–80 cm, stem light yellow, leaves dark green, $2n = 40$, Ac. No. 70/3, (38) Height 180–225 cm, robust, stem yellow, leaves dark green, $2n = 60$, Ac. No. 578/2, (39) Stem red, leaves dark green, rest as above, Ac. No. 508, (40) Height 80–90 cm, $2n = 40$, Ac. No. 90/4, (41)Height 180–225 cm, robust, stem red, leaves reddish, $2n=60$, Ac. No. 578/5.

Biotypes of *Ischaemum rugosum*.—All perennial, Loc. all, Palghar except biotype (45) which is Khandala, (42) Height 150–160 cm, erect, stem yellow, racemes glabrous with ridges across the lower glumes of both spikelets, $2n = 60$, Ac. No. 514, (43) Height 160–170 cm, erect, stem yellow, racemers hairy with ridges across the lower glumes of sessile and pedicelled spikelets, $2n = 60$, Ac. No. 515, (44) Height 140–150 cm, erect, stem reddish yellow, leaves dark green, $2n = 60$, Ac. No. 276, (45) Height 65–75 cm, semi-erect, stem reddish yellow, leaves dark green, $2n = 40$, Ac. No. 199/2.

Biotypes of *Ischaemum molle*.–All erect, annuals, Loc. all, Palghar except biotype (46) which is Khandala, (46) Height 70–80 cm, stem hollow and reddish yellow, lower glumes of sessile and pedicelled spikelets without transverse ridges on their backs and hairy all over, $2n = 30$, Ac. No. 191/8, (47) Height 190–210 cm, stem hollow, lower glumes of both spikelets with

4–5 transverse ridges with a few hair on the lower two ridges, $2n = 30$, Ac. No. 517, (48) Height 220–240, stem yellow and hollow, lower glumes of both spikelets without any markings and hairy all over, $2n = 30$, Ac. No. 522.

Biotypes of *Ischaemum santapaui*.—All 80–90 cm tall, erect, annuals, Loc. Rice Breeding Station, Karjat, (49) Stem solid and light yellow, lower glumes of both spikelets glabrous and without markings, $2n = 40$. Ac. No. 196, (50) As above excepting stem is reddish, $2n=40$, Ac. No. 194, (51) Stem yellow, lower glumes of both spikelets glabrous with three pairs of inconspicuous nodulose marginal ridges in the lower half, spikelets glabrous, $2n = 40$, Ac. No. 191/K, (52) Lower glumes of both spikelets with 3 to 4 oblique transverse wavy ridges, spikelets glabrous, $2n = 20$, Ac. No. 200/3, (53) Stem reddish, spikelets hairy, lower glumes without markings, $2n = 40$, Ac. No. 193/3, (54) Spikelets hairy, lower glumes with 3 nodulose marginal ridges, $2n = 40$, Ac. No. 196/6, (55) Spikelets hairy, lower glumes with 3 oblique transverse wavy ridges, $2n = 40$, Ac. No. 196/7.

Biotypes of *Ischaemum diplopogon*.—Both 30–40 cm tall, annuals, $2n = 20$, Loc. Khandala and Kune Mission Stream near Khandala, (56) Erect, stem yellow, lower glume of sessile spikelet has a bulge in the lower third with two tufts of hair above the middle, spikelets glabrous, Ac. No. 9/3, (57) As above but with semi-erect habit, Ac. No. 9/4.

Biotypes of *Ischaemum kingil*.—(58) Erect, 45–50 cm tall, perennial, leaves tapering at base and apex, upper side of leaf lamina dark green and backside bluish dark green, upper glumes of both spikelets with two tufts of hair and hump on upper third, stem light green to yellow, $2n = 20$, Ac. No. 576.

Biotypes of *Ischaemum impressum*.—Both annuals, 16–17 cm tall, $2n = 20$, Loc. Mahabaleswar. (59) Bushy, leaves light green tapering at base and apex, lower glumes with semi-circular ditch, upper glumes, keeled with tuft of hair on either edge, racemes glabrous, Ac. No. 201/10, (60) As above except that racemes are hairy, Ac. No. 201/9.

Biotypes of *Ischaemum pilosum*.—(61) Perennial, rhizomatous, stem yellow, racemes 4 to 6, 12 cm long, $2n = 60$, height 90–110 cm, leaves bluish green, Loc. Poona, Ac. No. 567, (62) As above except that leaves are dark green.

Biotypes of *Ischaemum ritchiei*.—All 15–30 cm tall, semi-erect, annuals, $2n = 20$, Loc. Mahabaleswar, Khandala and Lonavala, (63) Spikelets brownish red, hairy, stem red, Ac. No. 200/9, (64) Spikelets brown, stem yellow,

Ac. No. 20/11, (65) Spikelets red and glabrous, stem red, leaves reddish green, Ac. No. 169/4, (66) Spikelets brown and glabrous, stem yellow, leaves normal green, Ac. No. 20/13, (67) Spikelets red, upper hairy, lower ones glabrous, Ac. No. 20/15.

Biotypes of *Ischaemum semisagittatum*.—(68) Height 30–40 cm, annual, erect, $2n = 20$, stem red, leaves dark green, three horizontal inconspicuous ridges on lower glume of sessile spikelets which are profusely hairy, Loc. Mahabaleswar, Khandala and Poona, Ac. No. 170/3, (69) As above excepting stem is yellow, Ac. No. 170/5.

Biotype of *Ischaemum flumineum*.—(70) Spreading rooting at the nodes, central stems 40–50 cm tall, stems red, upper glume of sessile spikelet glabrous with a wing on edge on the upper half, racemes with double rows of spikelets, plants perennial, $2n = 40$, Loc. Lingmala Mahabaleswar, Ac. No. 519.

Biotype of *Ischaemum thomsonianum*.—(71) Spreading rooting at the nodes with tuft of leaves at each node, central stems 40–50 cm tall, plants perennial, $2n = 40$, Loc. Mahabaleswar, Ac. No. 580.

Biotype of *Ischaemum lisboe*.—(72) Spreading rooting at the nodes, white broad wings on the upper half of lower glumes of sessile spikelets, plants perennial, Loc. Chiplun, Ac. No. 581.

Biotypes of *Ischaemum ciliare*.—All 30–40 cm tall, annuals, $2n=20$, Loc. Chiplun, Awashi, Mahabaleswar and Khandala. (73) Stem deep red, leaves reddish green, spikelets red with red broad wings on either sides of upper half, Ac. No. 52/12, (74) As above except that spikelets including wings are yellow, Ac. No. 52/13, (75) As above except that spikelets are winged on one side of upper half only, Ac. No. 52/14, (76) As above except wings on the spikelets rudimentary, Ac. No. 52/15. (77) Stem yellow, leaves normal green, two papery whitish wings on the upper half of lower glumes of sessile spikelets only, Ac. No. 52/16.

Biotypes of *Chrysopogon montanus*.—(78) Stem yellow, leaves dark green, folded along midrib at base, plants perennial, 120–140 cm tall, erect, Loc. Poona, Ac. No. 102, (79) As above except that leaves are bluish green, Loc. Nagpur, Ac. No. 108.

Biotypes of *Sehima nervosum*.— (80) Erect, 90–110 cm tall, perennial, stem yellow, leaves light green with flat base, racemes 8–10 cm long, ligule 0·5 mm long, leaves have crisp papery feel, $2n = 40$, Loc. Dhulia, Amravati and Nagpur, Ac. No. 509/10, (81) As above except that leaves are bluish

green, Ac. No. 486/3/3, (82) As above except that stem is red and leaves reddish green, Ac. No. 558, (83) Erect, 150–210 cm tall, robust, perennial, stem yellow, leaves dark green with scabrid margins and rounded base, ligule 2 mm long, racemes 15–17 cm long, leaves have a tough feel, Loc. Lonavala and Khandala, Ac, No. 509/2.

Biotypes of *Sehima sulcatum*.—(84) Erect, 65–75 cm tall, annual, stem yellow, leaves dark green on both faces and glabrous and have crisp papery feel, Loc. Hingoli, Ac. No. 490, (85) As above except stem is red, Ac. No. 491/2, (86) Stem yellow, leaves bluish green, rest as above, Ac. No. 491/3, (87) Stem reddish, spreading rooting at the nodes, leaves light green, rest as above, Ac. No. 491/7.

Biotypes of *Iseilema wightii*.—(88) Stem yellow, leaves dark green, plant height 100–120 cm, erect and perennial, Loc. Palghar, Ac. No. 12, (89) Stem red, rest as above, Ac. No. 13.

Biotypes of *Iseilema laxum*.—(90) Stem yellow, leaves light green, plant height 60–80 cm, perennial, erect, Loc. Nagpur, Ac. No. 16/3, (91) Leaves dark green, rest as above, Ac. No. 4–1, (92) Stem red, plant spreading but not rooting at the nodes, rest as above, Ac. No. 10–1.

Biotypes of *Heteropogon contortus*.—(93) Erect, 50–60 cm tall, perennial, leaves dark green, racemes hairy, Loc. Poona, Ac. No. 502/3, (94) Leaves bluish green, racemes glabrous, plants have tendency to spread out, rest as above, Ac. No. 502, (95) Erect, 20–30 cm tall, annual, leaves light green, racemes hairy, Loc. Poona, Ac. No. 503.

Discussion

The foregoing account of botanical characterization indicates an appreciably wide spectrum of intraspecific variability in most of the grasses studied. In fact, some of these intraspecific variants such as annual or perennial forms with different chromosome numbers could as well deserve a taxonomic status of a sub-species to be designated by means of a trinomial nomenclature such as *Heteropogon contortus* forma *perennis*.

It is likely that some of the above biotypes may be just segregating genotypes as a result of introgressive hybridization in their natural populations. Apart from such a possibility in individual cases some of the biotypes seem to be constant fairly well established forms. This stabilization may be due to (*a*) ecologically isolated populations, (*b*) difference in chromosome

numbers preventing inter-crossing, (*c*) perennial vegetative or clonal habit and (*d*) apomixis.

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